Structural, morphological and shielding effectiveness properties of Yttrium Iron Garnet/Epoxy composites at X-Band frequency prepared via solid state reaction method

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ABSTRACT

The fast progression of microwave absorption technology has caused electromagnetic interference (EMI) or electromagnetic pollution into a worrying situation. Aside from causing adverse effects on industrial apparatus, EM pollution also carries a threat to human health as well. This problem can be prevented by applying Yttrium Iron Garnet (YIG) from Yttrium (III) oxide, Y2O3 and Iron (II) oxide, Fe2O3 as EM shielding material to lessen the EM pollution and interferences. The YIG samples were prepared using a solid-state reaction method and sintered at 900 °C to obtain a single phase of garnet. An epoxy resin was used as a matrix and mixed with YIG with 0 wt%, 5 wt% and 20 wt% compositions of the fillers. The stretching vibrations of the functional groups were analyzed using Fourier Transform Infrared (FTIR). The X-Ray Diffraction (XRD) analysis at a diffraction angle of 10° to 80° confirmed the presence of YIG phase at 900 °C with the average crystallite size was 49.28 nm calculated using Scherrer calculator in X'pert Highscore software. The morphology was determined by Field Emission Scanning Electron Microscope (FESEM) where it is smoother and more homogeneous embedded in the polymer matrix as the composition increases. A Vector Network Analyzer (VNA) was used to measure the shielding effectiveness and the introduction of the sample with the composition of 20 wt% YIG as the filler showed the increment of shielding effectiveness with 1.91 dB which is 4 times higher compared to pure epoxy at the X-band frequency. The results show that the structure and properties of filler materials strongly influence the shielding effectiveness of the composite.

KEYWORDS

Nanocomposite; Shielding effectiveness; Solid state method; Yttrium iron garnet

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